The new CAMS Radiation Service v4.5 – method improvements and variability class-dependent validation

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Objective & Background

The Copernicus Atmosphere Monitoring Service (CAMS) provides open data access to solar irradiances through its CAMS Radiation Service (CRS). Observations from the MSG meteorological satellites are combined with modelled aerosols, water vapor, and ozone from the CAMS Integrated Forecasting System. CRS data is provided from 2004 to the day before yesterday. Time series in 1 min, 15 min, hourly and daily temporal resolution are produced 'on-the-fly' on user request - using the most recent method and input datasets at the desired location inside the domain of the MSG satellite view. In addition to the standard access as time series, a gridded dataset in 0.1° and 15 min for the years 2004-2022 has been created for land surfaces of Europe and Africa.

Method

CRS v4.5 was released in 2022 and uses APOLLO_NG for deriving cloud information based on a probabilistic cloud detection. Its usage in Heliosat-4 follows a detection approach that is highly optimized for solar energy needs. The method is operationally applied for Europe, Africa and the Middle East, but has also been tested for Asia/Australia, and North and South America.

The derivation of the radiation at the earth's surface was extended by a parameterization of circumsolar radiation and provides a more accurate validation of the direct radiation with pyrheliometers.

Based on ground measurements, variability classes of radiation can be distinguished. This is an implicit description of different cloud situations derived from insolation. This allows a finer validation of the radiation depending on the weather situation and the distinction of the influence of clouds and aerosol effects.

CRS v4.5 switched to CAMS reanalysis as input. This allows improved accuracy for all years 2004 – 2020 compared to the usage of the CAMS IFS in its various versions over time. This accuracy gain is larger for years before 2020 with their older CAMS IFS versions used in the CRS before v4.5.

Principal Findings

The bias correction methods previously used have compensated for offsetting errors due to aerosols and clouds in particular, obscuring the opportunity for improvement in both the cloud and aerosol algorithms. Various method improvements have eliminated the need for operational bias correction in the CRS.

As a typical improvement from CRS v3.2 to CRS v4.0 (new cloud scheme, bias correction active) to CRS v4.5 (new clouds, new CAMS reanalysis, no bias correction active) Fig. 1 shows scatterplots at the BSRN station Carpentras for 2018 as arbitrarily chosen example. These scatterplots show 1 min resolved data to illustrate the method improvements in a very large level of detail. Typical usage of such data is in 15 min or hourly time steps which reduces especially RMSE values very significantly.

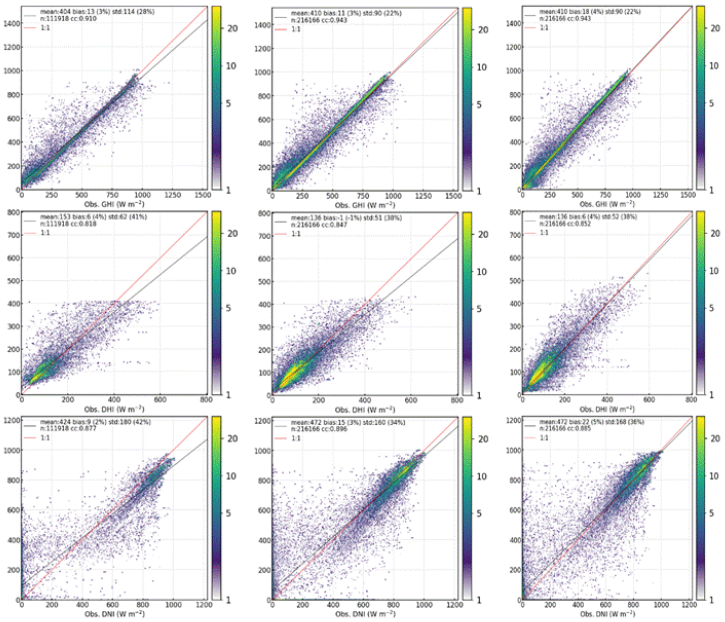

Fig.1 Scatterplots of 1 min resolved global horizontal (top), diffuse horizontal (middle) and direct normal irradiation (bottom) for CRS v3.2 (left), v4.0 (middle) and v4.5 (right) at station Carpentras.